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(58) Field of search  
B6F  
H1R

## (54) Keyboard

(57) A modular keyboard assembly comprises a mother board 2 and one or more auxiliary boards 3, 4. The mother board 2 contains the electronic line scanning and encoding circuitry 13 for all possible combinations of key switch functions. It also contains the common core 8 of key switches required for all applications. All the key switches 8' and 8'' which are additional to the common core switches are provided on one or more auxiliary keyboards 3, 4, each of which contain the necessary tracks relevant to all the key switches excluded from the mother board, but no scanning and encoding circuitry. On the mother board the tracks relevant to the switches on the auxiliary boards are all taken to male and female connectors 14, 15, on both sides of the mother board.

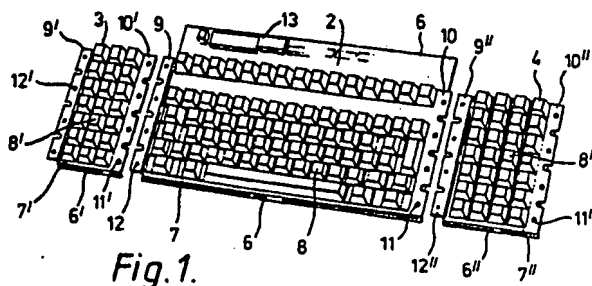
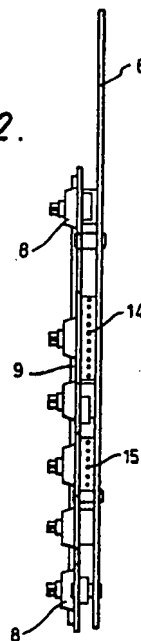


Fig. 1.

Fig. 2.



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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

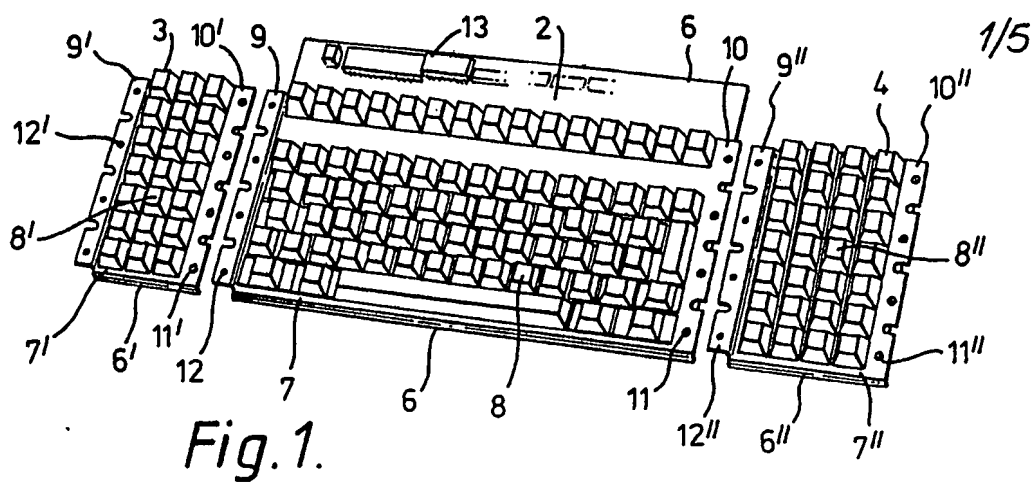
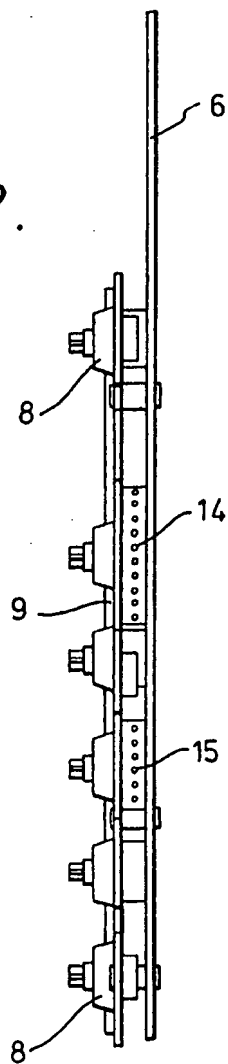


Fig. 2.



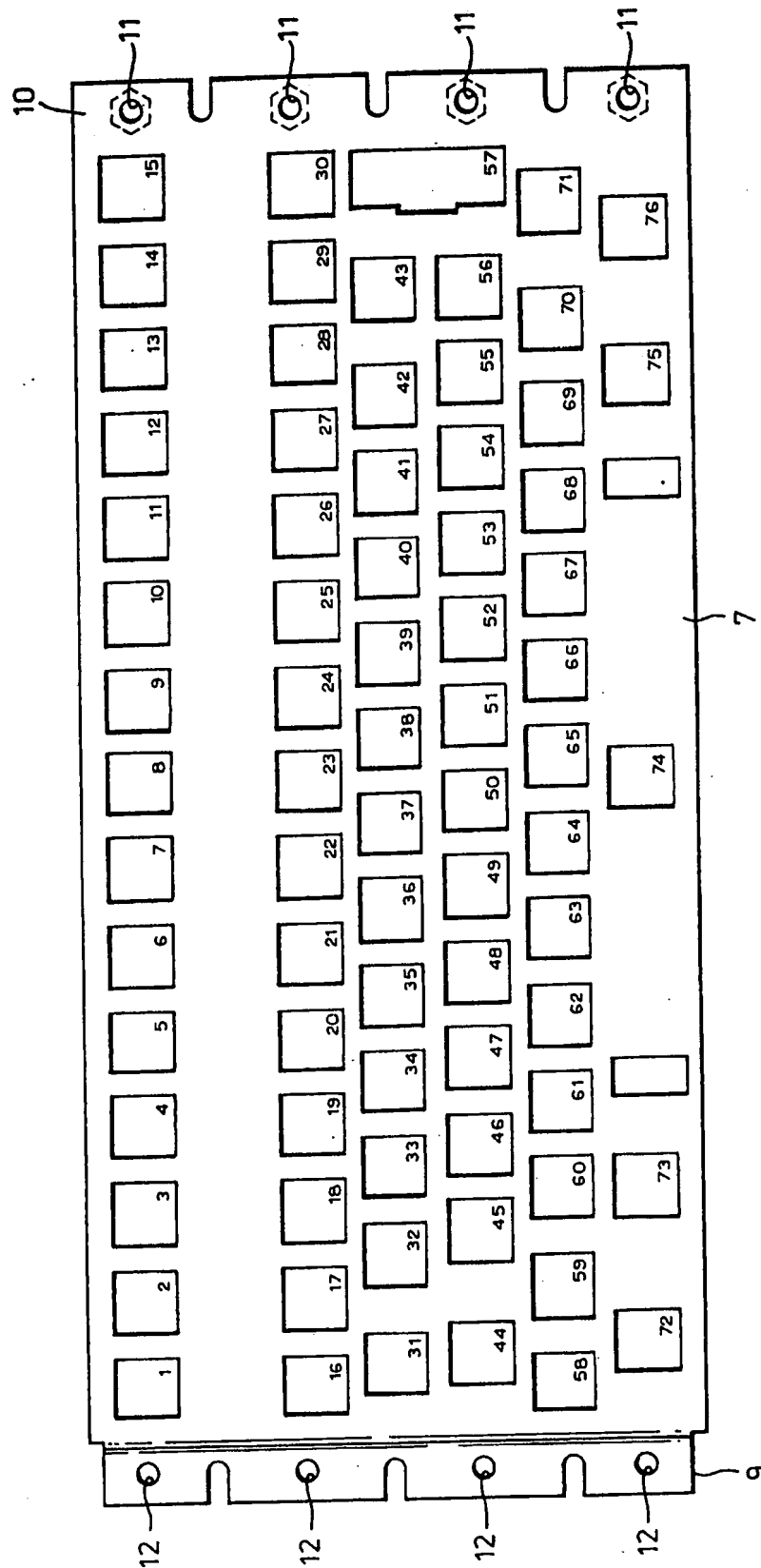


Fig. 3a.

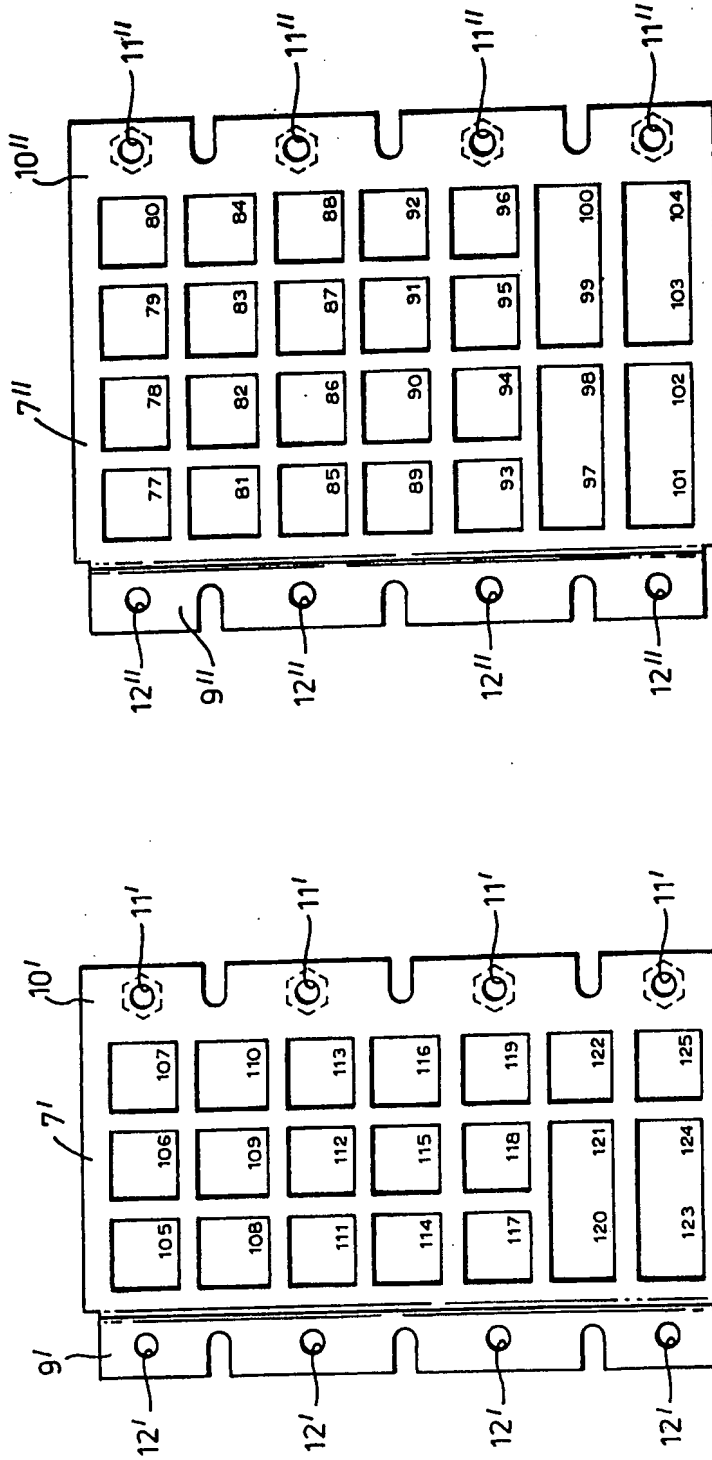


Fig. 3c.

Fig. 3b.

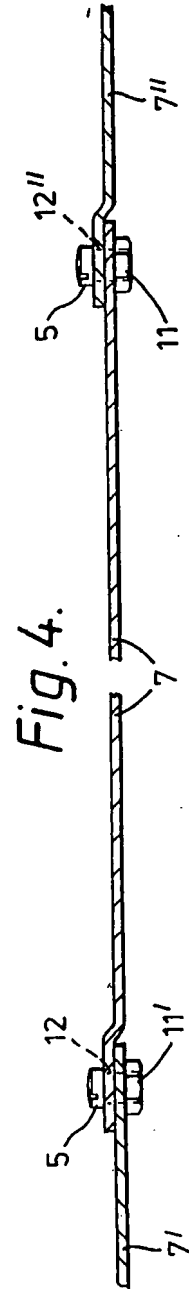


Fig. 4.

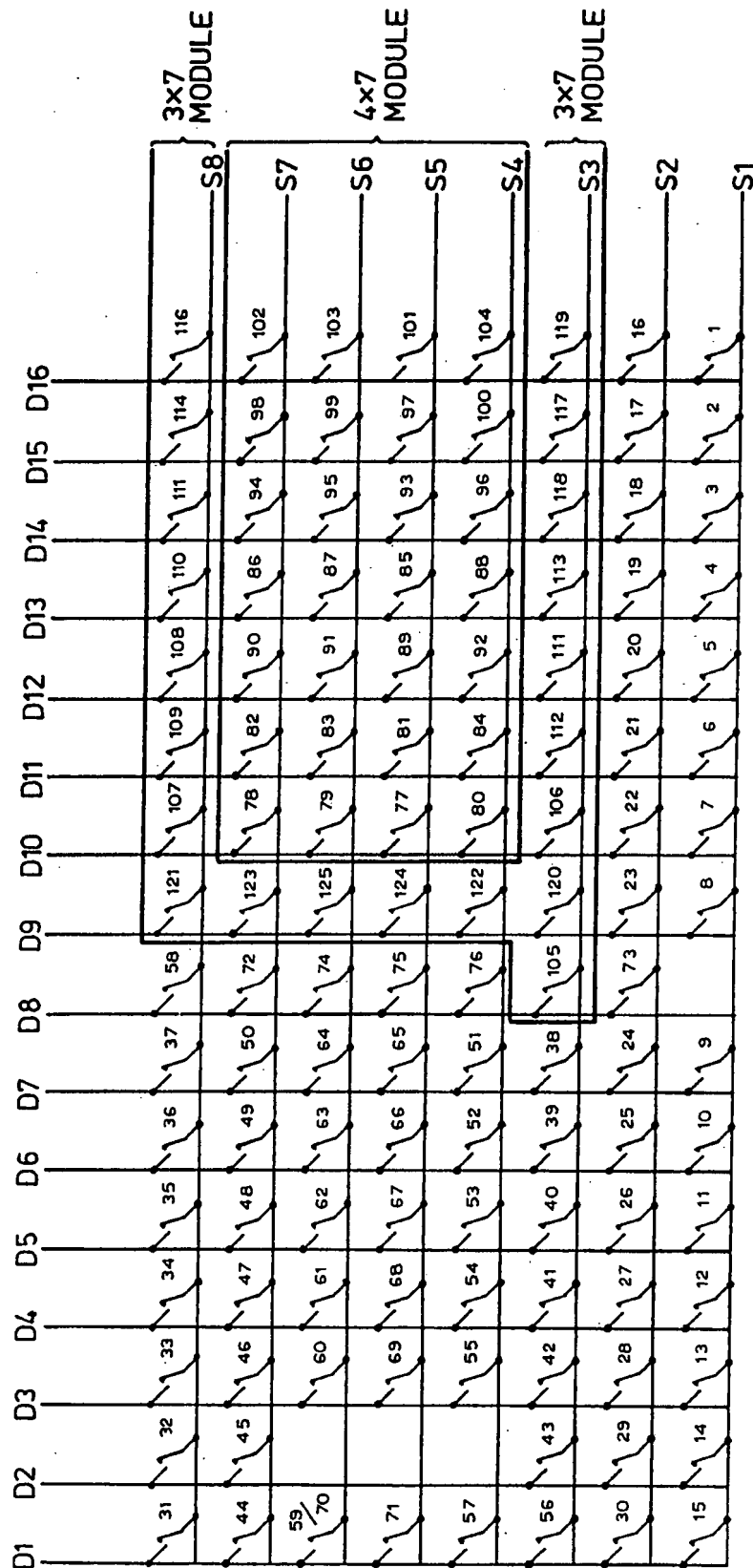


Fig.5.

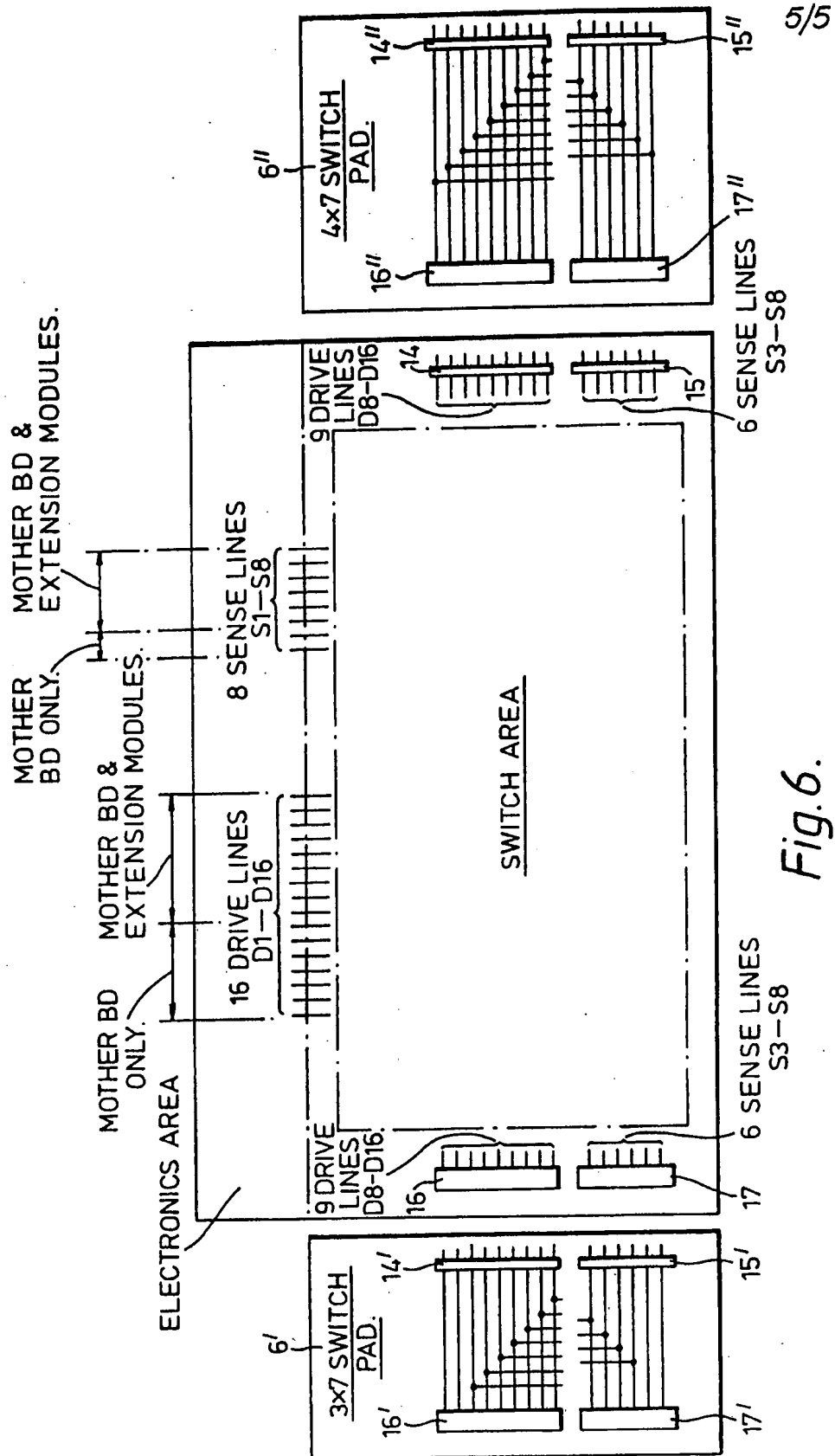


Fig. 6.

## SPECIFICATION

## Improvements in electrical keyboard construction

5 This invention relates to improvements in the construction of an electrical keyboard for use in a data processing system, and in particular to keyboards which have a common core of  
10 key functions usually following the QWERTY layout system.

A conventional keyboard used as a data-input device for computers and data processors consists of an array of key switches  
15 positioned in relation to or soldered directly onto a printed circuit board (pcb). A switch plate, through which the key switches pass and on which the pcb is mounted, also mounts the keys and gives rigidity to the  
20 whole construction. As assembled, the keyboard may also include a housing or it may be mounted, by means of its switch plate, into a console or a control panel.

The pcb comprises an array or net of conductors called herein "tracks" to which the individual key switches are soldered, or capacitatively coupled, each key switch being connected across or coupling an individual pair of such conductors. The pcb further comprises  
30 electronic scanning and digital-signal generating means which have the function of sequentially scanning the tracks for information identifying which keys are being operated and which use this information to extract from a  
35 memory for transmission the appropriate code signal corresponding to each depressed key.

Insofar as such keyboards incorporate key switches which relate to functions other than the common core of functions, they are realized by customer-dedicated designs in which  
40 each keyboard provides exactly what is demanded by the customer's specification, that is nothing more or less than the requirement. This has meant that there has been provided a  
45 distinctive layout of keys, a distinctive pcb and a distinctive key plate for each different requirement.

It is the object of the present invention to construct a keyboard in such a manner that it  
50 is formed of a plurality of modules, one of which always contains all the keys that are common to QWERTY-type keyboards and is therefore a standardized item. This keyboard is made fully functional; that is it contains all  
55 the electronics necessary for scanning the tracks and providing codes in relation to the depressed keys. Other ones of the modules will contain any special keys but to the extent that they comprise basic assemblies they may  
60 also be standardized.

Accordingly there is provided a mother keyboard and at least one other auxiliary keyboard coupled thereto wherein the mother keyboard comprises common core key switches and the remaining switches are provided

on one or more said auxiliary boards, said mother board further comprising a pcb containing scanning and encoding circuitry and all the tracks normally required to suit the full  
70 range of applications of the keyboard, which tracks, excepting those which connect only with the key switches contained on the mother board, are taken to side connectors on both sides of the mother board, there being  
75 female connectors one side and male connectors the other, so that they may be electrically coupled via complementary connectors to corresponding tracks occurring on respective  
80 pcb's of the said auxiliary boards, said mother board having a key plate which is adapted along both sides to receive and couple mechanically with respective key plates of said auxiliary boards, and said auxiliary boards having key plates mounting those key switches which have specialized functions assigned thereto and pcb's to which the latter  
85 key switches are connected which pcb's contain the said tracks coupled from the mother board but no sensing and encoding circuits.

The mother board has typically 76 key switches, two of which are duplicates. However, the accompanying pcb has sufficient tracks to accommodate 128 switches, all of which tracks are scanned sequentially by the  
90 electronics. There is also stored, in an appropriate manner on the pcb of the mother board, sufficient number of transmission codes for all the required switches. The excluded switches are provided to a greater or  
95 lesser extent on one or other of two auxiliary boards as required by the application. Typically, these auxiliary boards will have pcb layouts allowing for  $7 \times 4$  and  $7 \times 3$  key switch matrices on the respective boards but  
100 not all the positions are necessarily filled. These boards, as necessary, are custom configured with regard to key population to suit the particular application. They may be assembled all on the one or the other or on both  
105 sides of the mother board to suit customer requirements.

Hereinafter the invention is described by way of example and with reference to the accompanying drawings, wherein:

115 Figure 1 shows pictorially the total keyboard layout comprising a central mother board according to the invention and two auxiliary boards, in this instance each being provided with a full complement of key switches and shown ready for mounting one on each side of the mother board.

Figure 2 shows an enlarged end view of a mother board;

Figures 3a, b and c show respectively the switch plates of the mother board and the left and the right auxiliary boards;

Figure 4 shows a cross-section through the switch plates when assembled together;

Figure 5 shows diagrammatically, and in  
130 abstract form, the full track matrix with identi-

fication of the switch positions corresponding to those shown on the switch plates and showing those switch positions which are external to the mother boards;

- 5 Figure 6 shows schematically the input and output track arrangements on the pcb of the mother board and the connections specific to the pcb's of the auxiliary boards.

Referring to the drawings, in particular to  
 10 Figures 1 to 3, a keyboard 1 is shown, isolated from its housing or console, comprising a common core section 2 (referred to hereinafter as the mother board) and left and right auxiliary boards 3, 4, shown separated  
 15 from the mother board but which are to be joined thereto. Each board contains a pcb 6, 6', 6'', supported by a key plate 7, 7', 7'', of appropriate dimensions. An array of key switches 8, 8', 8'' are mounted in apertures on  
 20 the respective key plate and each is coupled to an individual pair of tracks carried on the associated pcb. Each key plate has a pair of flanges 9, 10, 9', 10' and 9'', 10'' which extend in the general plane of the board, one  
 25 on each side thereof. Each flange 10, 10', 10'' on the right of the respective key plate has a row of threaded fasteners 11, 11' or 11''. The flange 9, 9', 9'' on the left of each key plate is upwardly offset and has a row of  
 30 apertures 12, 12' or 12''. When the auxiliary boards are joined to the mother board the adjacent respective flanges are overlapped and the apertures register with the corresponding fasteners. Coupling of the boards is  
 35 completed by entering screws 5 (see Fig. 4) through the apertures into the fasteners and tightening them.

The pcb 6 of the mother board contains the electronic components and associated circuitry  
 40 13 required for scanning all the tracks on all the pcb's forming the board and for encoding the scanning signals and providing the transmission codes. The mother board pcb is therefore larger than the key plate 7 associated therewith. The pcb's 6', 6'' of the auxiliary boards contain only tracks, to which  
 45 tracks the auxiliary board key switches are coupled.

The view in Figure 2 is an end view of a  
 50 mother board in which the key caps of the switches have been removed and the electronic circuitry has not yet been mounted on the pcb 6. Male connectors 14, 15, are positioned between the key plate 7 and the  
 55 pcb 6 and soldered onto the latter. Female connectors 16, 17, are similarly provided on the other side of the board. Being in horizontal alignment with the male connectors so as to mate with the connectors of the adjacent  
 60 board, female connectors 16, 17 are concealed in Figure 2 behind the male connectors 14, 15. Except that the pcb's of auxiliary boards do not extend beyond the area of the switch plates because they contain no elec-  
 65 tronics, and the fact that the switch arrange-

ments may appear different, the end profiles of the auxiliary boards are substantially identical with that of the mother board.

The switch plates of the mother and auxiliary boards, shown separated from the rest of the assemblies in Figure 3a, b and c provide a plurality of mounting apertures for the key switches, arranged in prescribed matrices and numbered successively from 1 to  
 70 125 so as to identify the switches. The manner in which these switch plates are mechanically coupled by means of the fasteners 11, 11' and screws 5 is specifically shown in the cross section of Figure 4.

80 A schematic diagram illustrating the electrical relationship between the key switches and the associated tracks is given in Figure 5. Therein 16 vertical tracks D1 to D16 generally described in the art as the drive lines  
 85 cross over (without direct connection) eight horizontal tracks S1 to S8 generally described in the art as the sense lines. These drive and sense lines are connected with minor exceptions across their interstices by the contacts of  
 90 the key switches 1 to 125 as shown. The numerals associated with each switch in the schematic relate to the switch positions identified by like numerals in Figure 3. Drive lines D1 to D7 and sense lines S1 and S2 connect  
 95 only to key switches 1 to 76. These switches are all contained on the mother board and therefore the tracks D1 to D7 and S1, S2 do not extend beyond the mother board pcb. The remaining drive lines D8 to D16 and the  
 100 remaining sense lines S3 to S8, besides connecting where relevant to switches on the mother board, connect also to corresponding tracks on both the auxiliary boards via the appropriate pairs of connectors 14', 15', 16,  
 105 17 and 14, 15, 16'', 17''. One switch position is shown with two numerals, namely 59 and 70, and the interpretation is that there are two switches connected in parallel at this interstice. The corresponding key switches are  
 110 in fact the "shift" keys. Switches 77 to 104 occupy a block of positions in the matrix on the right-hand side of the Figure and are physically contained on an auxiliary board which provides a 7 × 4 key switch pad.  
 115 Switches 105 to 125 occupy parts of the matrix surrounding the said block of positions and are physically contained on an auxiliary board providing a 7 × 3 key switch pad. Switches 77 to 125 connect variously to  
 120 various pairs of the tracks D8 to D16 and S3 to S8, and all these tracks are taken to the connectors 14, 15, 16, 17 on the two sides of the mother board so as to be coupled to corresponding tracks on the auxiliary boards.  
 125 There are four switch sites in the part of the matrix pertaining to the mother board which are unused.

The input and output track connections provided on the pcb's of the various boards are  
 130 shown in schematic form in Figure 6.



The two auxiliary boards 3 and 4 may, of course, have their positions interchanged. One or other may be omitted or they may be connected together and both coupled to just one side of the mother board. Thus there are eleven possibilities of assembling the mother and auxiliary boards. Whilst, in general, the mother board will carry a full complement of switches (including the standard QWERTY arrangement) the number and physical arrangement of switches on the auxiliary boards may vary between applications. Thus a very wide range of possibilities is catered for.

## 15 CLAIMS

1. An electronic keyboard assembly, for inputting data to a data processing system, comprising a mother board having first and second sides and having connector means at each of said sides for electrically and mechanically coupling at least one auxiliary board thereto, said mother board having all the switch function tracks associated with the total number of key switches which can be provided on the keyboard assembly, the scanning and encoding circuitry for all the said tracks, and the common core key switches only, said tracks excepting those which connect only with the common core key switches on the mother board being taken to electrical connectors on both said sides of the mother board.

2. An electronic keyboard assembly according to Claim 1 further comprising at least one auxiliary board having connector means at least on one side whereby it can be electrically and mechanically connected to at least one side of the mother board, said auxiliary board having a plurality of switch function tracks corresponding to those tracks on the mother board which are taken to the connectors at the sides, said auxiliary board being dependent upon the scanning and encoding circuitry of the mother board and having no scanning and encoding circuitry of its own, said auxiliary board having a portion of such key switches as are excluded from the group of common core switches situated on the mother board.

3. An electronic keyboard assembly according to Claim 2 wherein the at least one auxiliary board has connector means on both sides each adapted for electrical and mechanical connection selectively to another auxiliary board and/or to one or other of both sides of the mother board and wherein the two connector means are electrically connected in parallel to the switch function tracks on the auxiliary board.

4. An electronic keyboard assembly according to any preceding claim wherein the or each keyboard comprises a respective key plate and a respective printed circuit board containing the switch function tracks to which the key switches connect.

5. An electronic keyboard assembly according to any preceding claim wherein said mother board and any auxiliary board for connection to the mother board respectively have female electrical connectors on one side and male electrical connectors on the other.

6. An electronic keyboard assembly substantially as described herein with reference to the accompanying drawings.

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